NASA Project Management Challenge 2009

PROJECT MANAGEMENT CHALLENGE 2009

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ABSTRACT AND BIOGRAPHY

Combining Probabilistic Estimates to Reduce Uncertainty

Suppose the project manager (PM) has obtained ***n*** independently developed and equally credible probabilistic cost estimates of his or her project, such that each estimate is expressed via a probability distribution or S-curve. The PM wants to consider combining these ***n*** estimates to obtain one estimate that is more reliable (i.e., less uncertain) than each of the ***n*** estimates individually. Two questions then arise: (1) How should he or she "combine" the estimates, and (2) Will the combined estimate actually be less uncertain than each of the ***n*** independent estimates individually. In order for this issue to be meaningful, we must assume that each estimate is "correct," i.e. (1) none is either too optimistic or too pessimistic, but is based on risk assessments validly drawn from the same risk information available to each estimating team; (2) each estimating team has applied appropriate mathematical techniques and engineering assessments to the cost-risk analysis, including (for example) inter-element correlations when appropriate; and (3) each estimating team was working from the same ground rules, but may have applied different estimating methods and made different assumptions when encountering the absence of some required information. The coefficient of variation (ratio of standard deviation to mean) is a common measure of the uncertainty inherent in a cost estimate expressed as a probability distribution. This presentation proposes a numerical test to determine whether the weighted (by their respective coefficients of variation) average of the three estimates is less uncertain than the least uncertain of the ***n*** original estimates.

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Dr. Stephen A. Book, as Chief Technical Officer of MCR, LLC, is responsible for ensuring technical excellence of MCR's products, services, and processes by encouraging process improvement, maintaining quality control, and training employees and customers in cost and schedule analysis and associated program-control disciplines. Dr. Book has served on national panels as an independent reviewer of NASA programs, in particular, the 1997-98 Cost Assessment and Validation Task Force on the International Space Station ("Chabrow Committee") and the 1998-99 National Research Council Committee on Space Shuttle Upgrades. He was a technical advisor to the 1990-1991 NASA Synthesis Group ("Stafford Committee") on the Space Exploration Initiative of those years and a member of the 1996-2000 NASA Ames Research Center Project Manager's Independent Review Team for the Stratospheric Observatory for Infrared Astronomy (SOFIA). Dr. Book joined MCR in January 2001 after 21 years with The Aerospace Corporation, where his title was "Distinguished Engineer" during 1996-2000 and his position was Director, Resource and Requirements Analysis Department, during 1989-1995. He is co-editor of the joint technical periodical *Journal of Cost Analysis and Parametrics* of the International Society of Parametric

Analysts (ISPA) and the Society of Cost Estimating and Analysis (SCEA). Dr. Book earned his Ph.D. in probability and statistics at the University of Oregon.